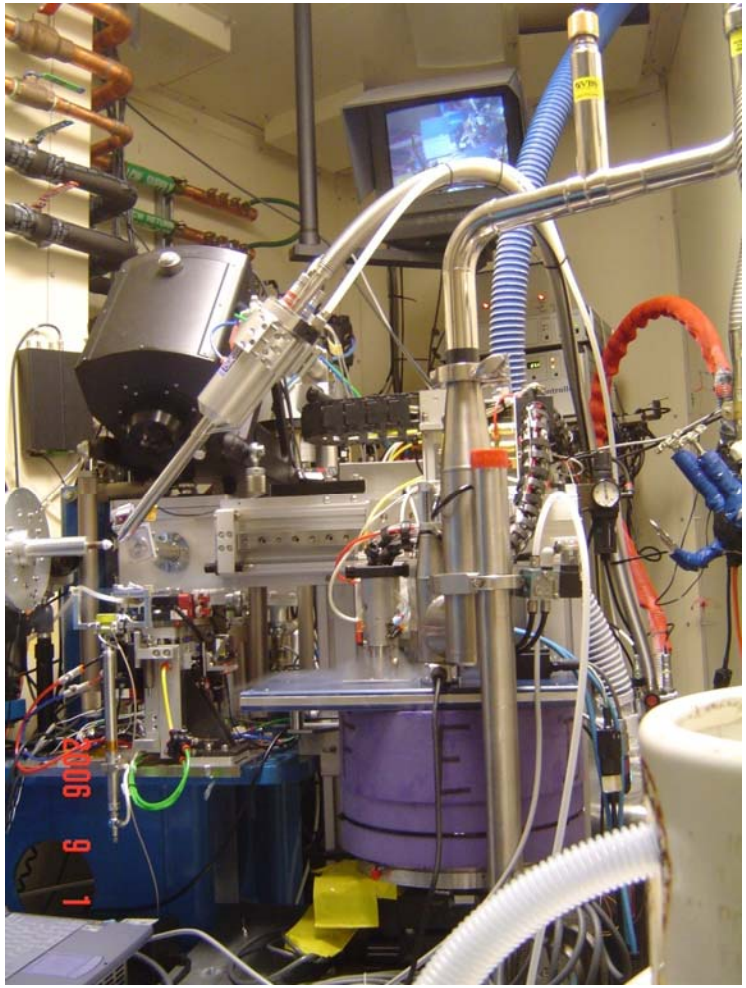
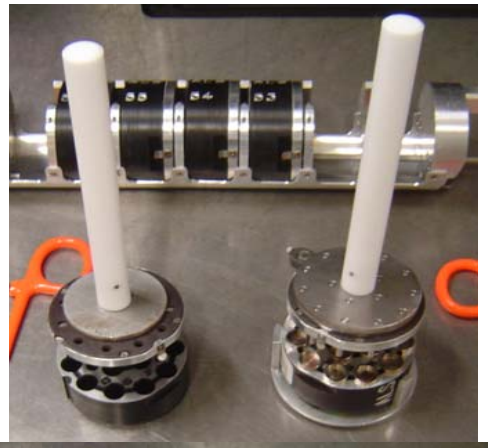
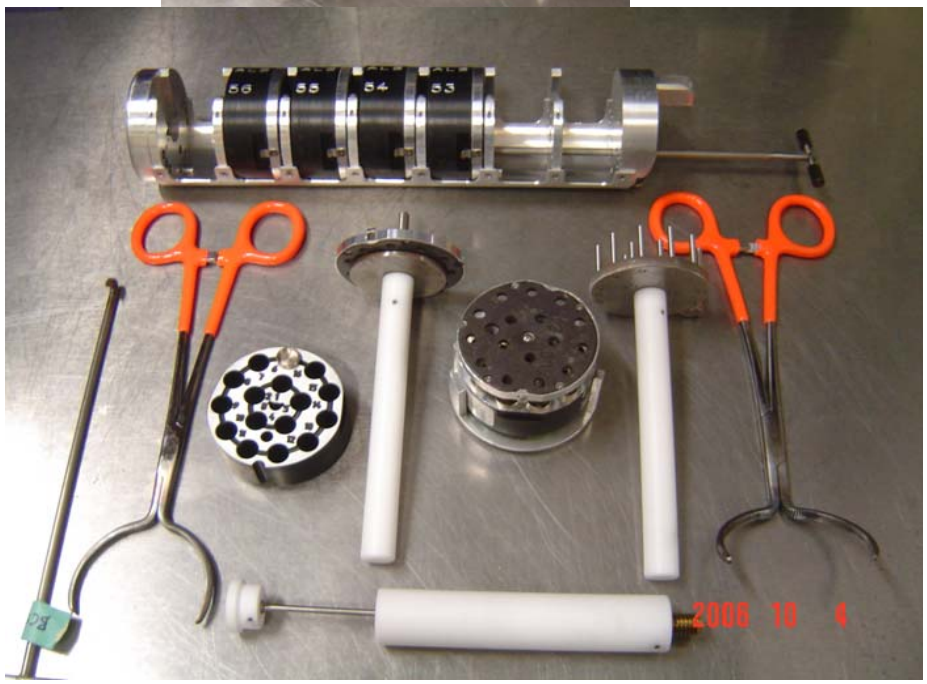
The Use of the Uni-Puck for Automated Sample Mounting at the ALS

5.0.1, 5.0.2, 5.0.3

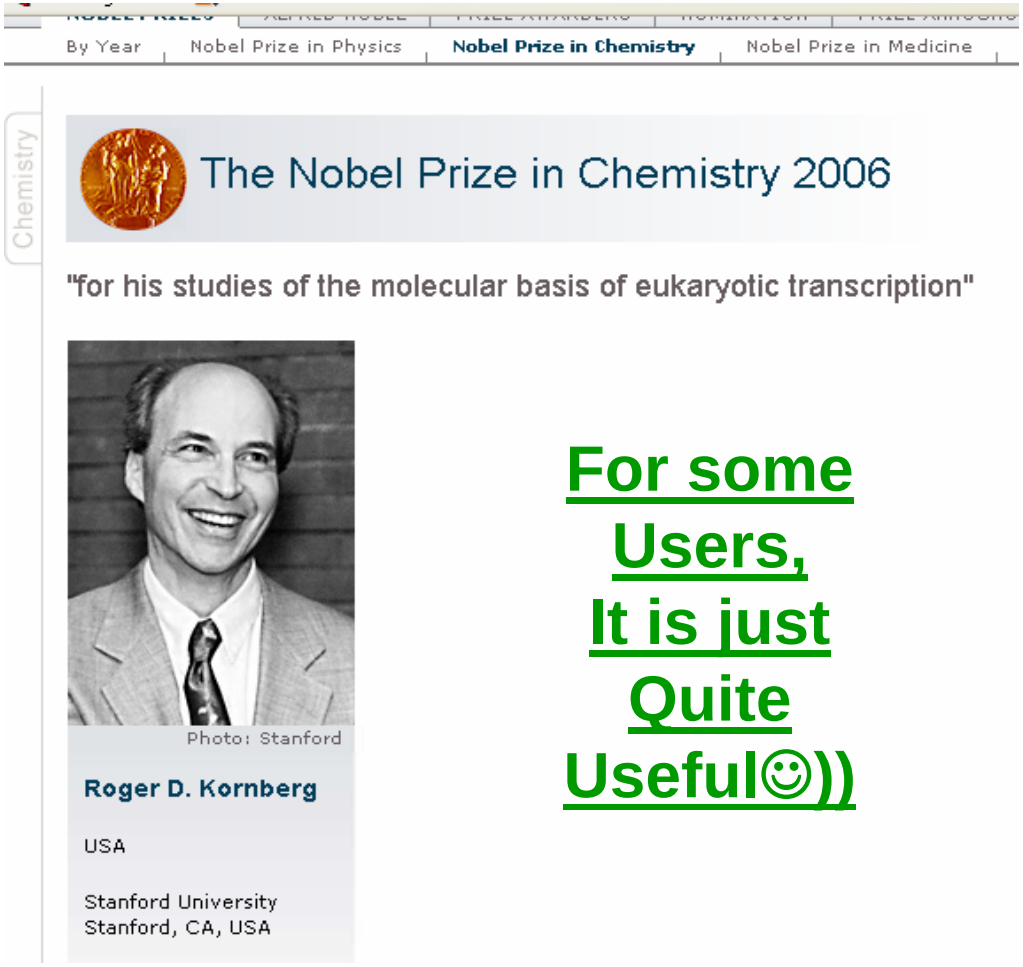
Christine Trame







How much worth is the robot???



For some Users, It is just Quite Useful☺))

GOOD FEATURES:

- Speed (**3-5 sec**, NOT 5min when manually)
- Experimental repeatability
- Reliability
- Easy in use
- **Available to every user**
- **Now: sample packaging adapted for more than one robotics system available across synchrotron sources**

ALS LN2 safety procedures:

1. When filling the handheld dewars, use face shield and cryo-gloves (the large blue gloves).

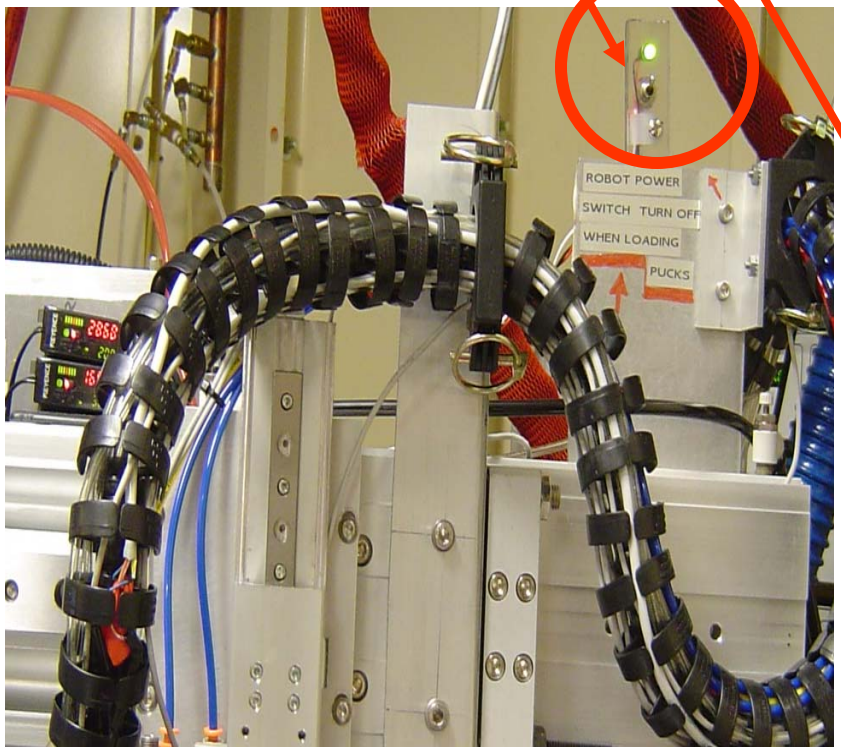
2. When filling the purple dewars from the hand-held dewars, also use face shield and cryogloves.

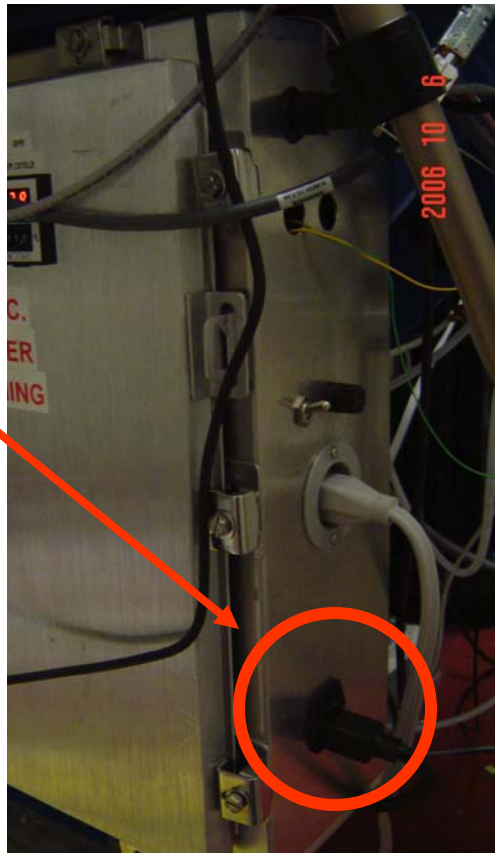
MUST

3. When manipulating samples in the purple dewars and transferring samples to the goniometer using cryotongs, use the smaller safety glasses, and use cotton gloves covered with latex gloves.

MORE ON ROBOT SAFETY FEATURES:

- **OFF/ON switch** disconnecting the robot WAGO system from the main control computer sending the motion commands to the robot. (users safety)
- in progress: automated switch coupled to the floor mat surrounding the robotics table (users safety)
- Complete shut down of the robot (most serious emergency)





Arrange your visit, shipment and get the proper training before the data collection

- http://bcsb.lbl.gov/auto.htm
- Arrangements For Use (SLGoff-Ortega@lbl.gov)
- Automounter Equipment Requirements
  pbboyd@earthlink.net
- Per tools+pucks Set : $3100.0
- Taylor Wharton CP100 shipping dewar or 34HC storage dewar
- Take ~(0.5-1) additional hour to your first visit for Robo-training
- Read about starting your sample preparations at home:

http://bcsb.lbl.gov/USER_MANUAL/HTML-MANUAL-2.htm

ALS versus UNI pucks:

All what you know about ALS robot in the past:

-pucks loading for transportation

-pucks transport

-pucks storage

-pucks retrieval out of the CP100 dewars

-pucks loading into the ALS robots

-pucks usage with the ALS robots

-tools usage

is the same for the UNI puck.

To obtain UNI PUCKS contact:

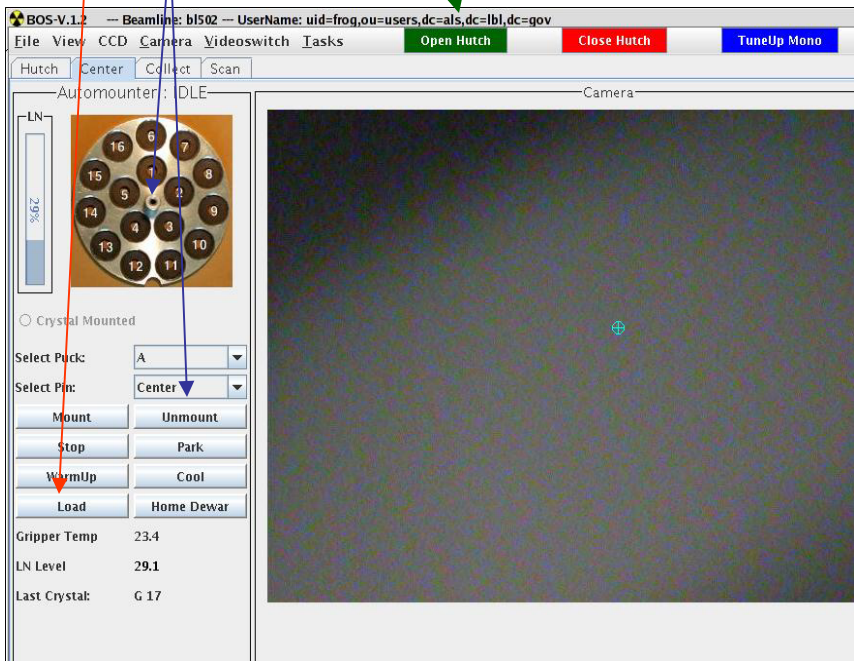
acohen@slac.stanford.edu

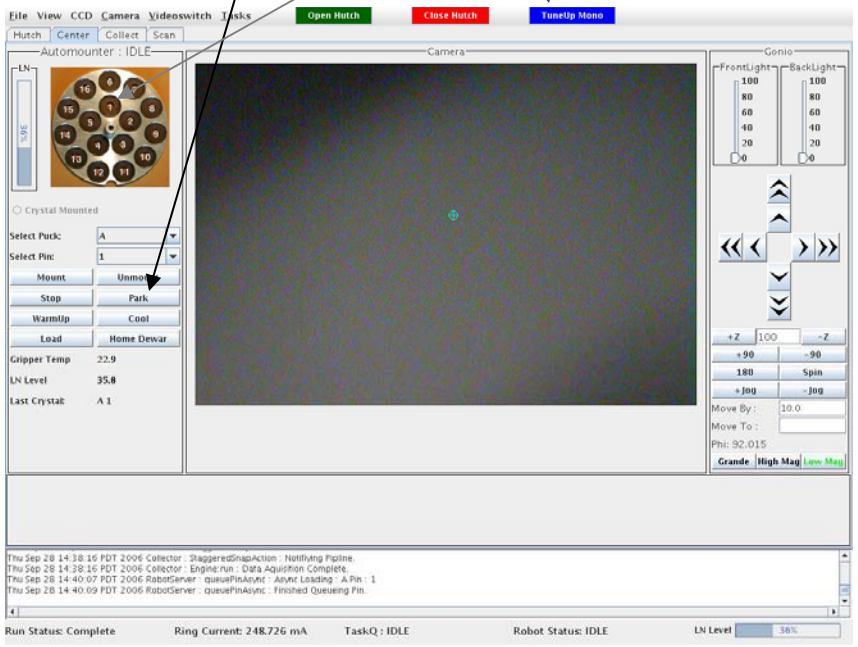
Prepare the robot for loading through the BOS software GUI:

1. Open Hutch
2. Load
3. A-F ‘CENTER’

After you are done with loading, closing the small lid, setting the hutch interlock, Toggling the shutter switch…

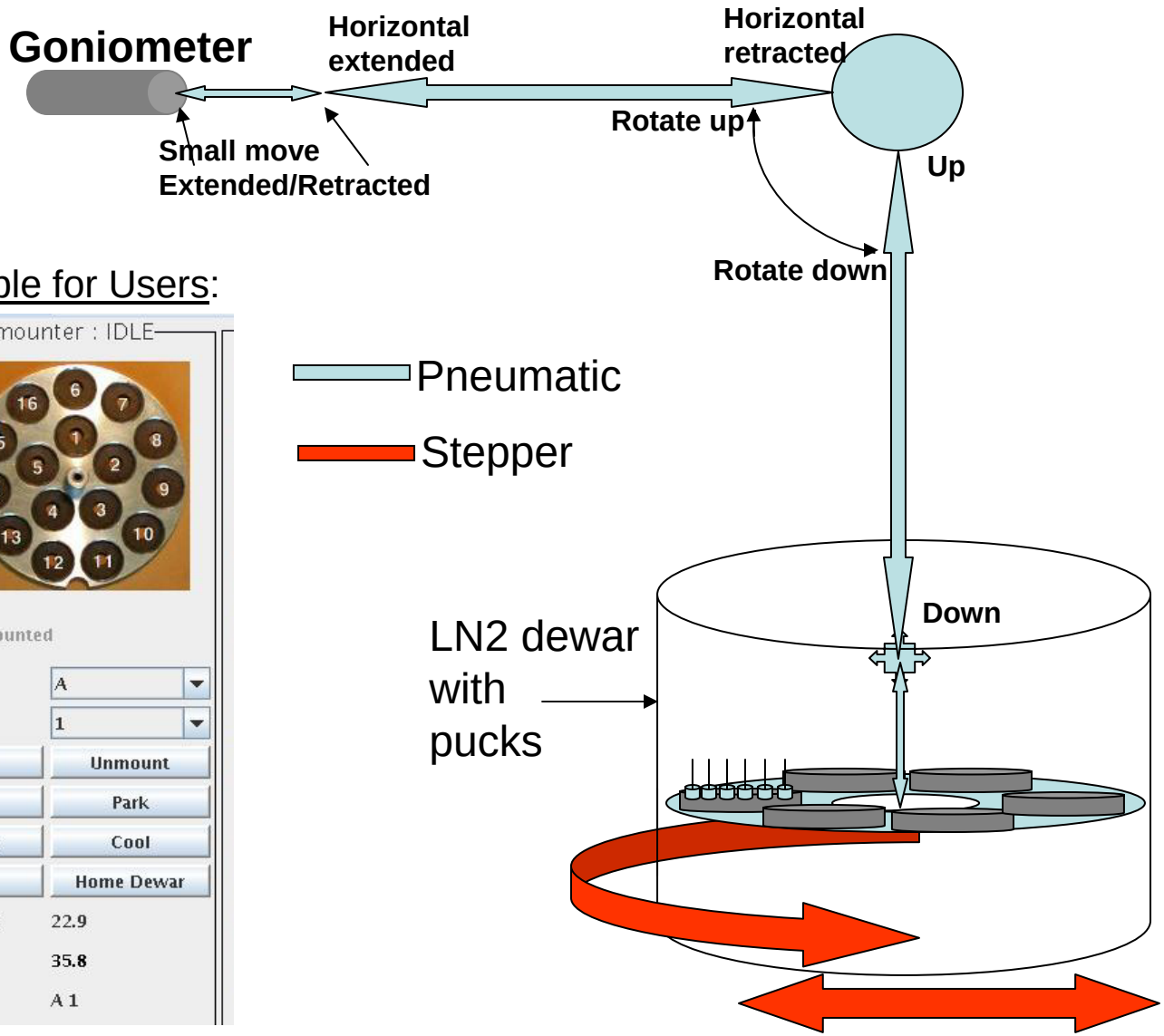
1. ‘Park’
2. ‘Close Hutch’
3. Center on the first pin ‘A1’





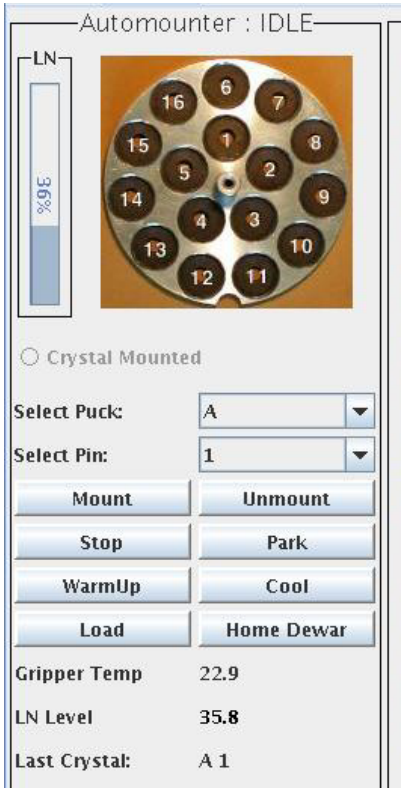
Basic ALS Robot Motions:

- Big move up/down
- Small move extend/retract
- Rotate up/down
- Horizontal extend/retract
- Heater extended/retracted
- Grip/Ungrip

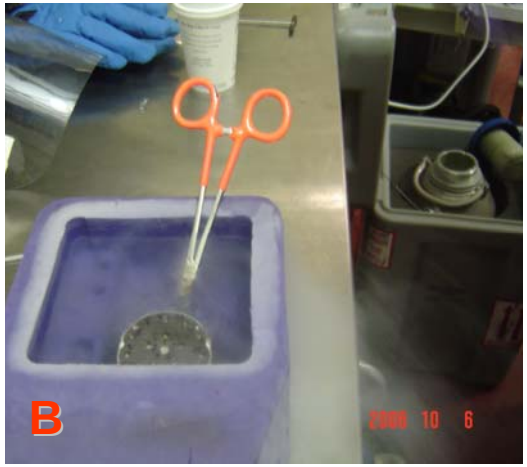


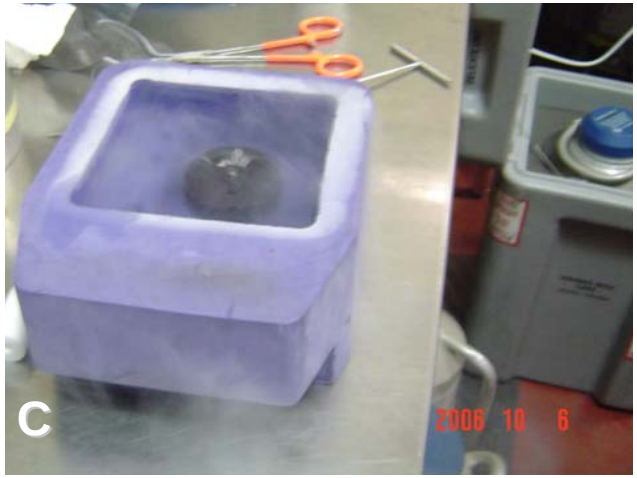
Combined Motions Accessible for Users:

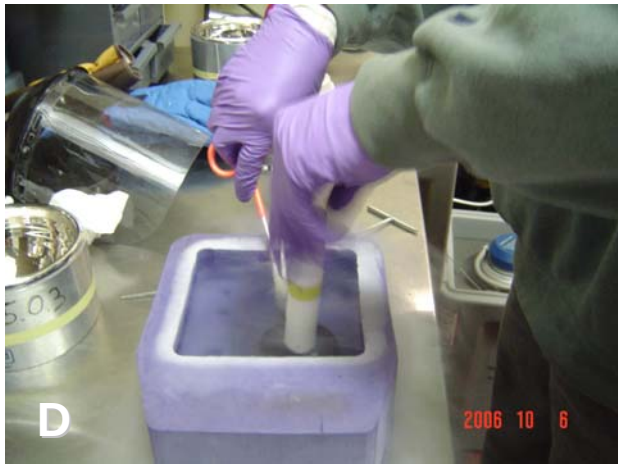
- Mount/Unmount
- WarmUp/Cool the gripper
- Park
- Load
- Home Dewar
- Stop



Loading the pucks into ALS dewar







A. Transfering the puck from the carrier to the small dewar (B)

B. Inspect the bottom of the puck for foreign objects!!!

Even small pieces of broken pins can be fatal to all your crystals in this puck, once it is positioned in the dewar!

C. Rotating the puck inside of the small dewar

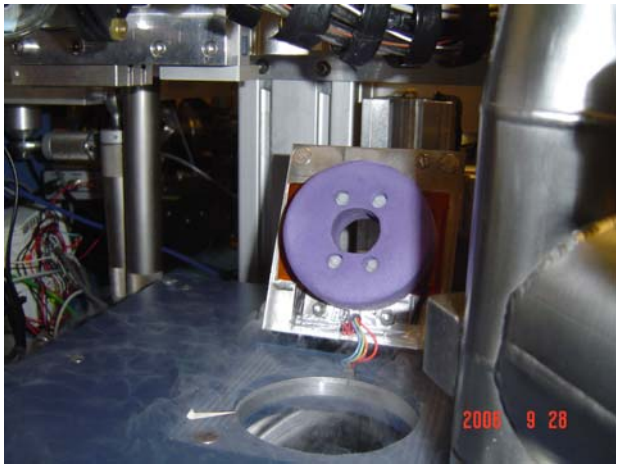
D. Screwing the pusher into the puck and preparing it for transfer into the hutch and the robot dewar

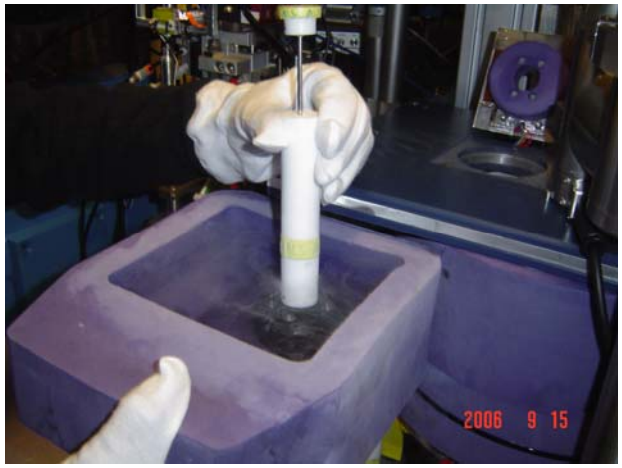
Puck loading continues …

Loading the puck into the 501 robot dewar …..

Don't forget to:

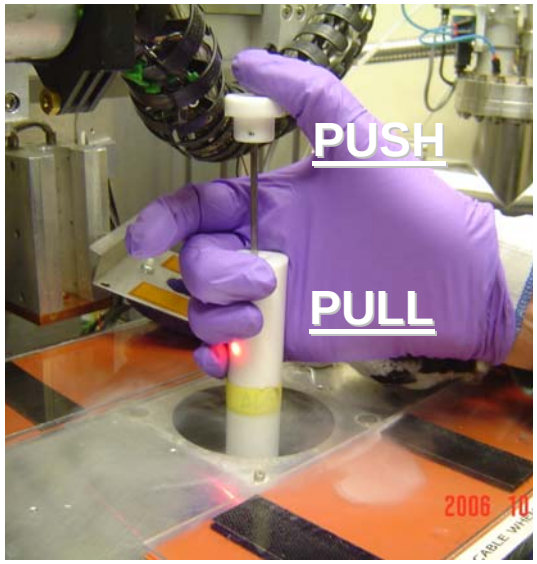
Close the small lid after you are done with puck loading!!

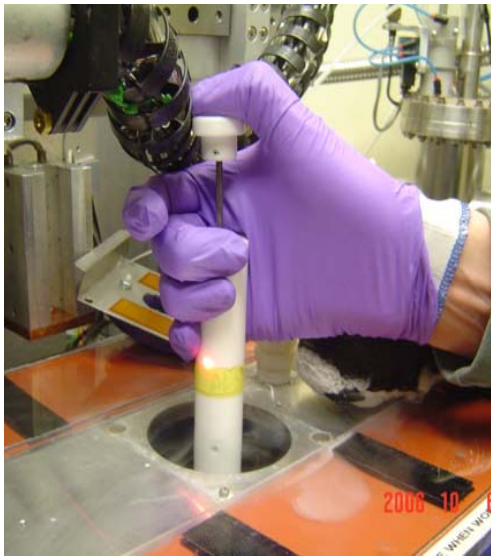


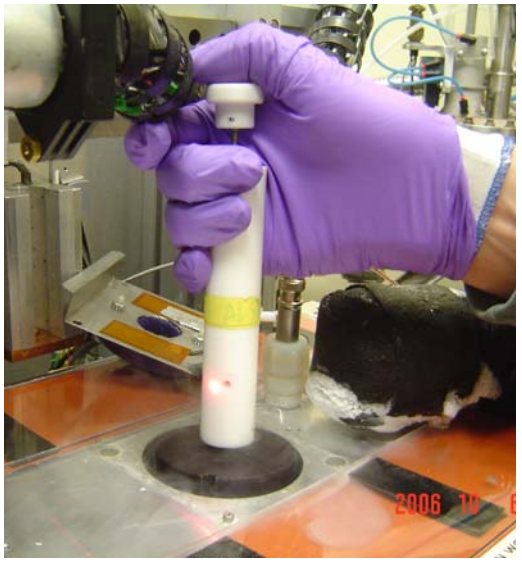


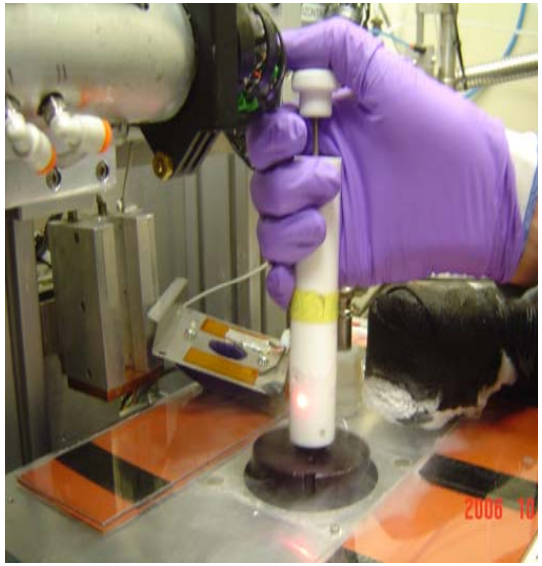
Once the puck sits properly mounted in the puck plate in the robot dewar, prepare for the last few steps….

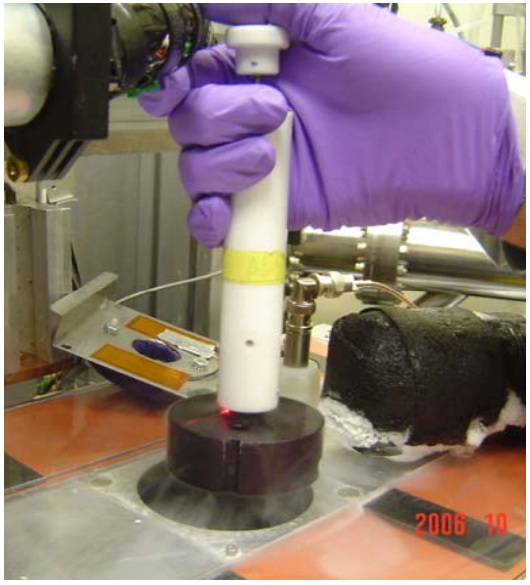
Puck loading….











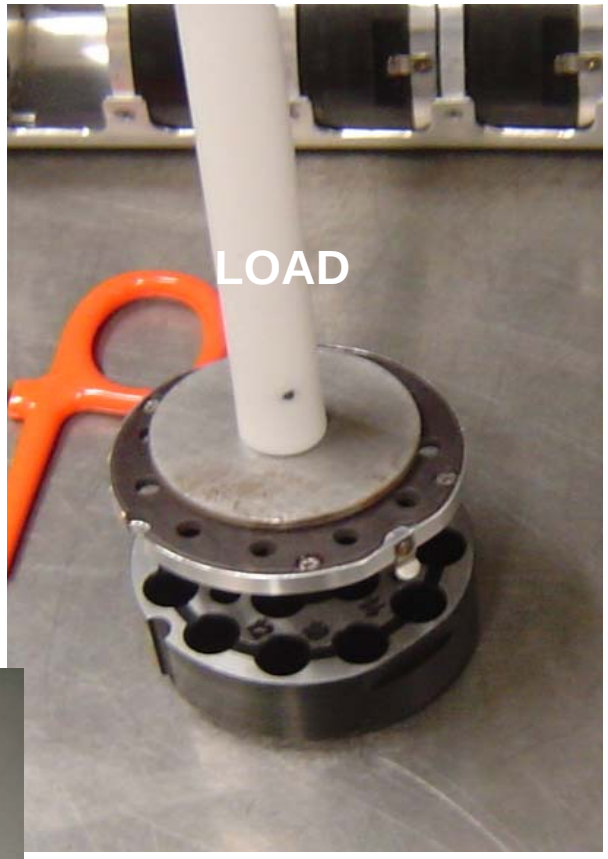
IMPORTANT:

ONLY AFTER you are not able to rotate the puck unit any more, push the rod and pull the pusher in the same time in order to separate the puck from the base and leave just the base alone with all the samples inside of the dewar

Retrieving the crystals from pucks back into aluminum cans / loading the pucks with crystals

Imagine all around is happening inside of the dewar with LN2

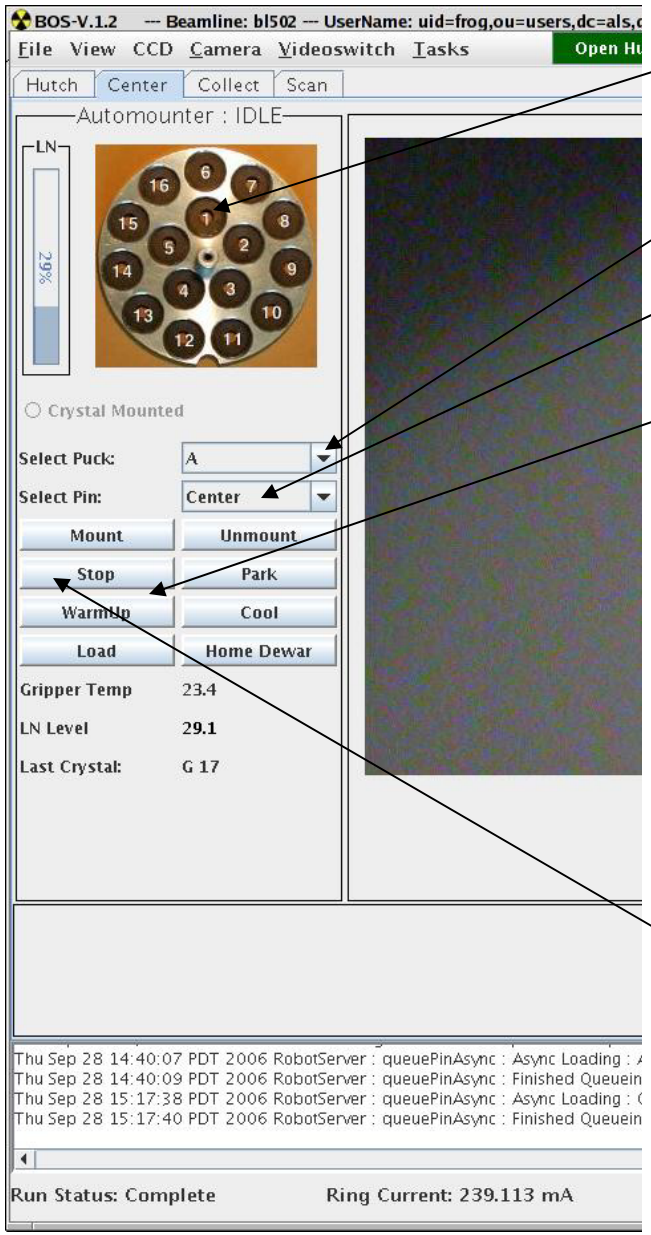
(if you don't have blue foam ALS dewars, don't choose deep dewars for puck loading)



KEEP ALWAYS the purple foam dewar ICE-FREE when handling pucks =>

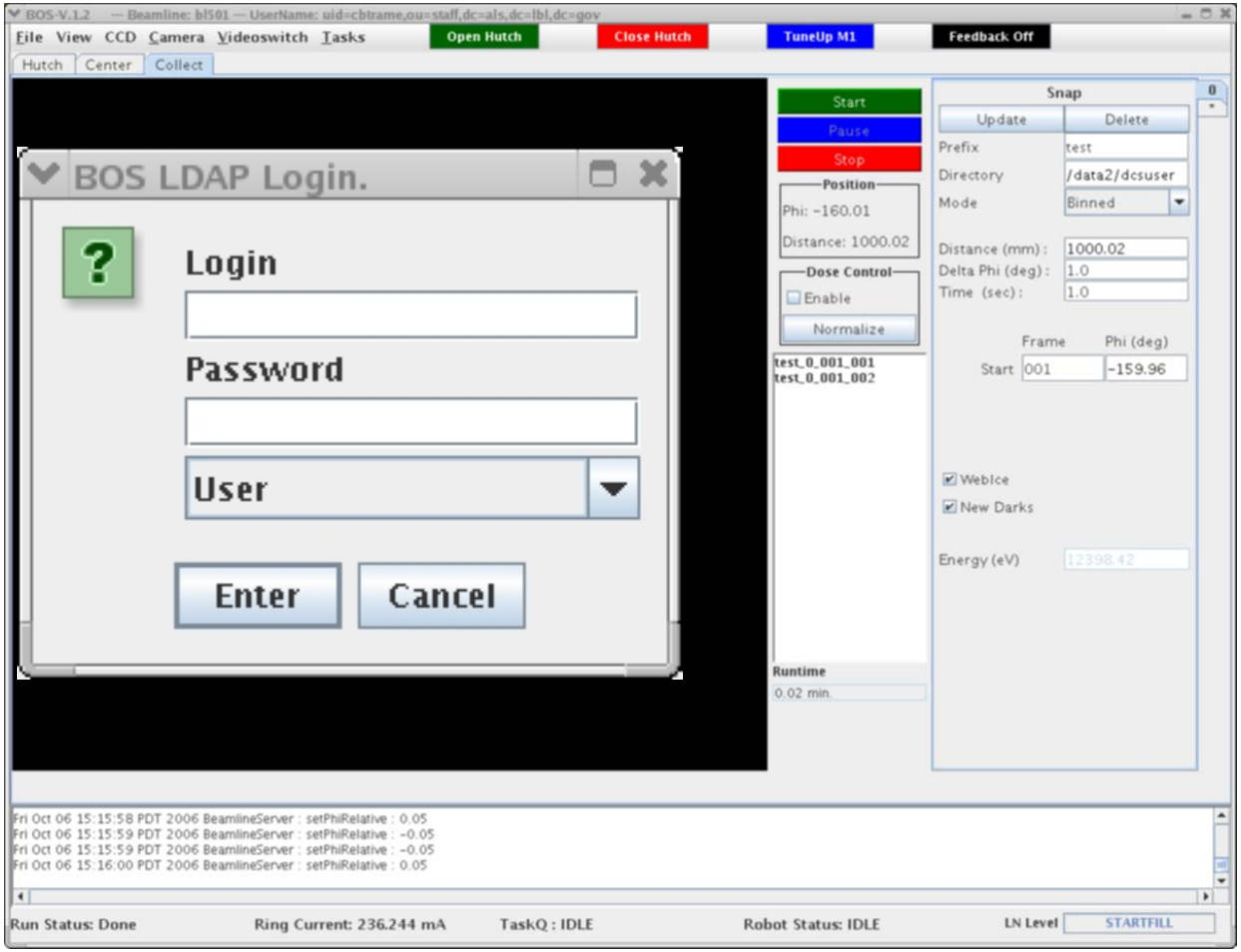
For blue dewars ask BCSB staff or contact:
jdspear@ alumni.princeton.edu
(at http://www.spearlab.com)

BOS GUI



1. **Pin choice** by direct click of the puck base photo
2. **Puck choice** by scrolling '<u>Select puck</u>' box
3. '**Center**' only for puck loading.
4. Frequent '**WarmUp**' cycles for gripper especially on 503 (every puck at least). Keep the gripper warm during longer data collection.
5. '**Load**' followed by '**Close hutch**' after puck load and setting the interlock system.
6. Select pin first, then '**Mount/Unmount**' to (put or take it off the goniometer.
7. To interrupt 'Mount/Unmount' or 'Warmup' click on '**Stop**'.
8. Keep an eye on '**Gripper Temp**.' and '**last crystal**' entry.

BOS => WebIce application



1. From any Sector 5 z-machine click the BOS icon
2. Type your **user password**
3. Choose ‘Staff’, if applies
4. Click ‘WebIce’ in the ‘Snap’ window
5. Start screening; follow up with the WebIce manual from Nick Sauter/ Ana Gonzales.

Most frequent problems:

- Too much icing on pins during loading the pucks with samples
- Not proper insertion of the puck into the carrier (ALWAYS hear the clicking sound of the puck being inserted into the loading canister)
- Forgetting about the insertion of the safety rod into the carrier before transportation.
- Not inspecting the pucks for bends, missing or loose springs or screws, especially after incidents of letting them fall down when cold
- UNI puck won't get out of the ALS dewar if the spring clips are not intact!!!
- Not watching carefully the software interface during X-tal mounts, unmouting x-tals one on top of each other!!

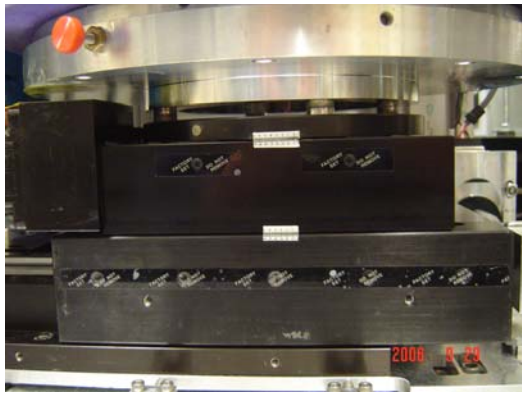
  Laser sensors watch for clean finish of mounts/umounts, but they won't protect you from the above problem completely
- Using the wrong style of pins (knocked over samples in the dewar)
- Not enough frequent warming up cycles of the gripper (mounting/unmounting failure)
- Miscommunication among users in larger groups having more complicated schedule:

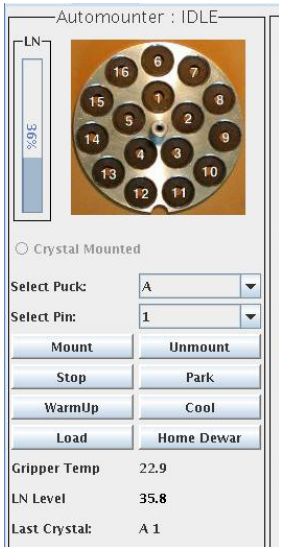
  While loading the pucks never allow anyone else sending commands to the robot.

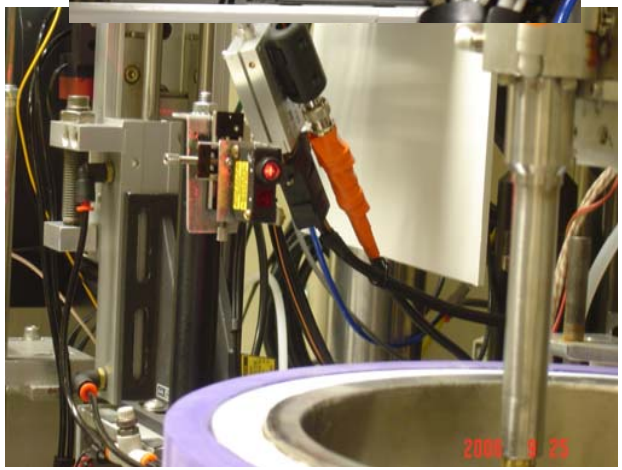
  (use the safety OFF switch mentioned in the begin of this talk)
- Forgetting to close the small lid ☹

Other sources of problems: Beamline hardware☹

1. Laser sensor misalignment
2. Air pressure loss or leak
3. Failure on pneumatic switches
4. Broken Gripper RTD
5. LN2 Robot Dewar Misalignment
6. SMART Motor failure
7. LN2 delivery issues
8. Network or computer problems
9. Broken heater wires
10. Goniometer problems, lost x,y,z coordinates
11. Broken gripper







In all cases call 2500 a.s.a.p. or the staff on duty

Some good statistics

- Robot users in average during 24 hours shift are capable of screening all their 96 crystals, collecting anywhere between 20-30 data sets on 502
- New UNI pucks were tested successfully with ALS robotics on 502/501 beamlines over a period of couple of days with hundreds of mounts/umounts without a failure.
- In the period 2005-2006 135 publications cite the use of sector 5.0 beamlines. In the same period a total of 220 structures deposited at the PDB cite sector 5.0 beamlines as the primary data collection source. PRT members collected 1902 data sets on sector 5.0, and solved 830 structures.

Acknowledgments

- **SAM group at the SSRL**
- BAM group at the ALS:

  - Thomas Earnest, Carl Cork, Earl Cornell, Georgy Snell, Jim Oneill
- John Taylor
- All BCSB members